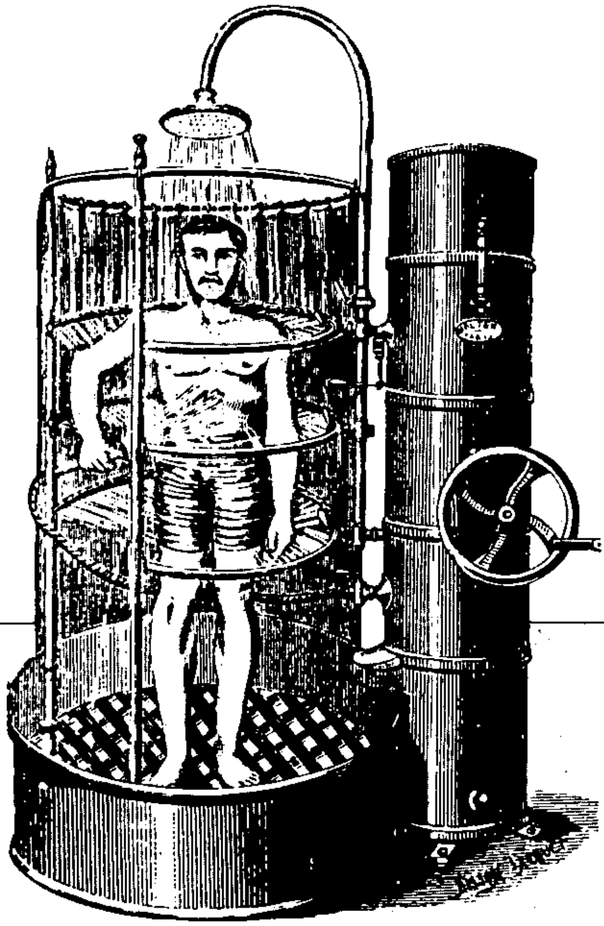
The Journal of the Institute of Hospital Engineering June 1980

HOSPITAL ENGINEERING

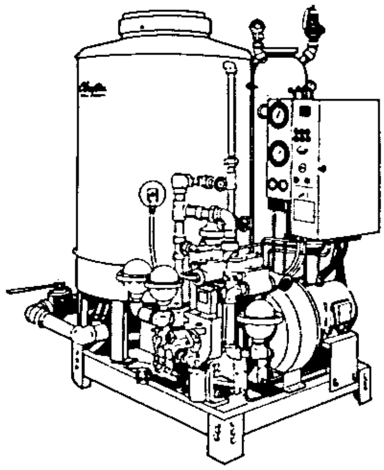
International Federation Issue

IFHE
The First Ten Years

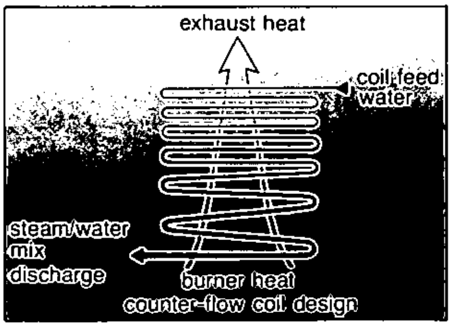


You wouldn't take a bath like this anymore, would you?

If not, you wouldn't think of specifying a boiler with yesterday's technology when you could have an energy-efficient Clayton steam generator.
These long life units require little maintenance and are capable of burning a variety of fuels. With their compact design, they occupy less floor space than a conventional boiler.



A Clayton steam generator operates at the highest possible efficiency, especially at fluctuating steam loads. A multiple unit installation gives you the ideal combination: **quick warm-up, steam output as required without a waste of fuel and a continuous steam supply.**



Ask for "The Clayton Investment Analysis Computer Program". A free survey of your existing installation is available on request

Voucher

Clayton 1930 1980

Clayton Thermal Products
12, Rivington Ct.,
Hardwick Grange
Woolston
Warrington, WA 14 RT
Tel. : 0785-53079
Telex : 627664

☐ I would like more information
☐ Please send me "The Clayton Investment Analysis Computer Program"

Name ____________________
Company ____________________ Function ____________________
Address ____________________
____________________ Tel ____________________

'Hospital Engineering' is published monthly, except in January, by Mallard Publications

Individual copies cost
£2.45 UK postage paid

The annual subscription is UK: £21.00
Overseas: £25.00 Americas: $56

Average circulation per issue
(January-December 1978): 2,347

ABC

Editor
Christopher Tanous TD

Advertisement Manager
Kate Oriel

All correspondence relating to the Journal should be addressed to:

'Hospital Engineering'
Mallard Publications
17 St Swithin's Lane
London EC4, England
Telephone: 01-623 2235

UK ISSN 0309-7498

Printed by JB Offset Printers
(Marks Tey) Ltd
Station Approach, North Lane
Marks Tey, Colchester, Essex

The Institute of Hospital Engineering
20 Landport Terrace
Southsea, Hants PO1 2RG, England
Telephone:
Portsmouth 23186 (STD 0705 23186)

Secretary
J. E. Furness VRD*

Hon Librarian
R. G. Smith CEng FInstE MCIBS FIHospE
Dryhill, Cold Slad
Crickley Hill, Witcombe
Glocestershire

The International Federation of
Hospital Engineering
126 Albert Street
London NW1 7NF, England

HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

International Federation Issue No. 34

I.F.H.E.

Contents

June 1980

Volume 34 No. 5

Institute News

Energy Conservation in Hospitals could save another £30 million a year

Sir George Young MP, Under Secretary of State for Health and Social Security spoke at the first Hospital Energy Conservation Year symposium held in London on March 26. Unfortunately, Patrick Jenkin MP, was unable to attend due to urgent parliamentary business, and we are grateful to Sir George for taking his place at short notice. The following is an extract from his speech:

"Energy costs in the health service today are over £150 million per annum — a figure which will at least double in the next twenty years if no action is taken. Savings must be made and it is realistic to cut £30 million off this fuel bill" said Sir George Young.

"Good housekeeping schemes are springing up in hospitals and already we've saved £20 million a year by energy conservation. We are determined to make savings wherever possible and devote that money to patient care. And we are determined to give more money to the health service as you will see when the Public Expenditure White Paper is published after today.

"When I talk about saving £30 million in fuel costs, it may sound like pie in the sky. But I'm convinced its possible. Enthusiasm and motivation are as important as technical knowledge. There are many turn-of-the-century hospitals where enthusiastic management has halved the fuel consumption, with a pay back on capital employed in about two years.

"Electronic energy control centres are already in use in some large hospitals and more are planned. The contribution of these new devices may well prove to be highly significant. Once experience has been gained, disseminated and discussed throughout the health service then I am sure we will be looking for ways and means to get them installed everywhere.

"Effectively energy conservation demands a diverse mixture of commonsense, management study and technical skill. Surveys have shown numerous cases where a whole building is heated for 24 hours a day, seven days a week, when just one room needed this service as the rest of the building was used only during weekday working hours.

"Some health authorities have used infra red aerial photography to survey widely dispersed sites and reveal zones of high heat loss due to lack of insulation. Clearly conservation is a truly broad spectrum problem requiring a multi-disciplinary attack. The greater the cost savings in energy, the more money we have for patient care. But there is also a national need for us to change out attitudes after years of prodigal consumption habits. Not only must we achieve economies for our own benefit but it is important that the health service, which is such an integral part of our national life should set an example to the whole population."

Sir George Young MP.

The £500 Energy Saving Competition detailed in the March issue of the journal has already resulted in a number of entries. Readers are reminded that all entries must be received by the Secretary of the Institute by September 15, 1980. So far, no entries have been received from abroad.

New Publication from CEI

To encourage interest from school leavers in Engineering the CEI has published a booklet "Options for Work". This is aimed at those who will be leaving school in a few years and are considering different careers. It outlines the different fields of engineering and explains the skills necessary, and training available for school leavers. Using colour illustrations throughout, the booklet attempts to encourage interest in the engineering professions.

Watt Committee Report on Energy Policy for Transport

The report which is now available suggests that rapid inflation which is promoted by escalating energy costs reduces the incentive to change from an existing vehicle to a more energy efficient replacement. Policy should concentrate on encouraging the production of energy efficient vehicles by a target date (say 1987); an economic policy which encourages changeover to new economic vehicles with the policy giving credit for load factor; and new construction of motorways and railways should be assessed in terms of future energy scarcity than by its current price.

Other aspects are dealt with in papers on policy making and fuel availablity. The conclusion is that a dependence on synthetic hydrocarbons is inevitable. There are papers dealing with "Road Vehicles of the Future", "Energy Conservation in the Railways", "Energy Saving in Ships" and "Air Transport Energy Requirements". Transport energy usage accounts for 22 per cent of the UK total, and requires nearly 50 per cent of our oil supplies. Any relief available from modern telecommunications is valuable and this dimension as well as the social aspects of change in transport patterns is dealt with in further papers.

The report "Towards an Energy Policy for Transport" is available price £20.50 including p & p within the UK from: The Watt Committee on Energy Ltd, 75 Knightsbridge, London SWIX 7RB. Airspeeded delivery to Europe costs an additional £1.50, and £3.00 to the rest of the world. (Alternatively, overseas surface mail costs an additional £1.30 per copy). Remittance in sterling on a London Bank.

Energy Simulation Program

The department of Health and Social Security (Works Group) have negotiated an agreement with Strathclyde University (ABACUS) for the unrestricted use of their Energy Simulation Program (ESP) within the NHS (England and Wales).

ESP is a computer program for interactive or batch operation concerned with the environmental aspects of a building's performance. Using the program, it is possible to define the building geometry, construction, occupancy/equipment usage profiles, and shading etc. This can be done to sufficient accuracy to permit a very detailed assessment of the building's environmental and energy performance.

ESP utilises a dynamic method which more closely approaches the actual energy flow through a building.

Validation tests have confirmed the predictive accuracy of the program. The program can be applied to new or existing buildings.

ESP forms part of a suite of computer programs that are being developed in associations with Regional Health Authorities for use by works professionals.

Welsh Branch Activities 1979/80

The 1979/80 programme of meetings got off to a good start on the evening of September 13, 1979 when Mr Duncan Strong, Technical Officer, WHTSO, gave a presentation on the subject *The Installation and Maintenance of X-Ray Equipment.* Hospitality was received from the Gwent Health Authority at the Nevill Hall Hospital, Abergavenny.

A small contingent from the branch were at HEC, Falfield, on October 16 at the invitation of the South Western Branch. All reported the usual warm welcome from our friends from over the Severn and their journey had been well rewarded by the subject, *Health Design for the Future* given by officers of the South West Regional Health Authority.

It was encouraging to see a further improvement in attendance at the 14th November meeting held at Singleton Hospital, Swansea. Mr Brian V. Williams and his colleagues Messrs Glyn Mogford and Brian Sullivan, all of WHTSO, spoke on the subject *Nucleus Hospital Engineering Services.* Particular reference was made to the Mowiston Hospital project in illustrating the Nucleus design and it was clear that the speakers had contributed considerable time and effort to a well presented talk.

In the New Year the branch may have started a new trend by holding a weekday afternoon meeting on January 22, 1980, at the University Hospital of Wales, Cardiff. The subject was *Incinerators and Waste Heat Recovery* a talk authoritatively presented by Dr Clive T. Chamberlain, Managing Director of Universal Machinery Ltd. The meeting also included a visit to the heat recovery plant at the University Hospital. In view of the improved attendance the Chairman suggested that an afternoon meeting could become a regular feature of the annual programme.

On March 18 a meeting was held at Lansdowne Hospital, Cardiff, when Mr Robert Calvert spoke on *Scavenging of Anaesthetic Gases from Operating Theatres.* Members will know of the current problems involved in obtaining effective removal of such gases. Unfortunately attendance at this meeting was a little disappointing.

An extensive agenda was dealt with at the Annual General Meeting held on April 16 at Prince Charles Hospital, Merthyr Tydfil: the meeting was well attended and active discussions ensued on a number of current topics.

The Officers elected for 1980/81 were: *Branch Chairman:* Mr R. R. Morgan; *Vice Chairman:* Mr B. V. Williams; *Hon. Secretary:* Mr D. Griffiths; *Hon Treasurer:* Mr. D. Hackett.

The following members were elected to the committee: Messrs P. Jackson, B. Ford, T. Roche, D. Lee, M. Back, R. Parsons, J. Burton, J. Jackson, R. Long, F. Beavan.

Mr E. A. Johnson retains office as Area Member of Council.

The highlight of the 1980/81 year will be the Weekend School organised for October 24-26, 1980, when the Institute President, Mr L. F. Turner, will visit the branch. A varied and interesting programme is promised and members will soon receive full details and registration application forms.

Yorkshire Branch visits British Rail, York

Over 25 members and their guests attended a visit to the British Rail Signal Box at York Station on Thursday April 17.

The signal box, although opened in 1951 is in all operating essentials, as up to date as the most modern signal boxes being installed today. It controls 33 miles of track and over 2000 train movements a day. The new box replaced seven manual-type signal boxes containing 846 levers with a semi-circle console on which 1000 hand switches are mounted.

A visit to the Telecommunications centre, one of the largest in the country, concluded a most enjoyable evening.

North Western Branch

On Saturday April 19 the branch visited Leighton Hospital, Crewe, the visit being arranged by Mr D. Foster the Chester Area Works Officer. The party which included wives and children was conducted on a most interesting tour of the hospital by Mr Mears, the hospital administrator, and Mr Brown, the District Works Officer, with special stops in the CSSD and Casualty Department, where the staff in charge explained the work carried out. A typical ward, the laundry and the boilerhouse were also visited. Mr Mears gave an interesting talk illustrated with slides on the various problems which have arisen in the first eight years since the hospital was opened. The visit concluded with a full buffet tea and the whole visit was thoroughly enjoyed by all who attended.

Institute 36th Annual Conference

Newcastle upon Tyne May 1980

This year's annual conference was held at the Holiday Inn, Seaton Burn, near Newcastle upon Tyne. Over 100 members and their wives attended, and the conference was the usual mixture of good technical papers and pleasant socialising.

Members arrived at Seaton Burn on the evening of Tuesday May 7, and the conference was opened the next morning by Mr G. R. Chetwynd CBE, Chairman of the Northern RHA. Members spent a solid day in the lecture room, under the chairmanship of Mr Tom Nicholls, Director of Operations and Chief Engineer, DHSS, while the ladies enjoyed the first day of their own special programme of local outings. Everyone then repaired to The Mansion House in Newcastle upon Tyne for a civic reception given by the City.

The Dinner Dance

After another day of papers, with Mr Bill Murray, Area Works Officer, Cleveland AHA in the chair in the morning, and Mr J. McDowell, Regional Engineer, Northern RHA, in the afternoon, the Conference Dinner Dance was held on Thursday evening. Unfortunately Sir George Young, the Parliamentary Under Secretary of State at the DHSS, who was to have proposed the toast to the Institute, was prevented by parliamentary business from attending. His place was taken at short notice by Robin Manser, Assistant Chief Engineer at the DHSS. He spoke briefly, but amusingly, confining himself largely to a modern fairy story, and a short dissertation on engineering history.

Responding, the President of the Institute, Mr Laurence Turner thanked Robin Manser for standing in, and greeted the Lady Mayoress of Newcastle upon Tyne, who was the Institute's chief guest for the evening, and Mr. George Chetwynd, who had not only opened the conference, but would be replying to the Toast to the Guests. He also said how pleased everyone was to see Mrs Vi Northcroft, whose late husband had been the first President of the Institute, and welcomed Mr and Mrs Ken Wilson. He is the Regional Works Officer for the North East, and the longest serving member of the Institute Council. Finally, the President pleased everyone by making a special mention of Mrs Beryl Furness, wife of the Institute's hard-working Secretary, who was present at the

The President, Mr Laurence Turner, proposes the Toast to the Guests at the Dinner Dance. From the left they include Mrs Northcroft, Mr Chetwynd, and the Mayor of Newcastle upon Tyne.

dinner for the first time for some years, and whose contribution to the Institute in earlier years was very well remembered.

Responding to the toast to the Guests, Mr Chetwynd said how very pleased he and his fellow Geordies were that the Institute had come to the North East. He went on to describe the current reorganisation of the NHS as another upheaval, and hoped for a quick and decisive review so that everyone could get on with the job. He trusted that the excellent service by the Institute and its members would receive its proper recognition — "Certainly" he said "engineers are making a greater impact now than ever before".

The Morning after

The next day, under the chairmanship of Hugh Howarth, a Past-President of the Institute, the speakers had to be good to overcome a certain drowsiness in some of their audience! That they succeeded says much for the excellent quality of the audio-visual presentation on air filtration by speakers from AAF Ltd whose factory nearby was visited by a quite a few members after the formal closure of the Conference.

The papers

The full list of the papers presented at this year's conference is as follows. It is hoped to publish many of them in future issues of *Hospital Engineering.*

A Review of Computing for Building Services by D. Curtis, a member of CIBS Computer Applications Panel.

Advances in X-Ray Equipment Design by R. T. Rogers, Head of the Electrical Engineering Group, DHSS.

C.T. Scanners by J. L. Williams, Principal Scientific Officer Physics R & D Group, DHSS.

Maintenance of X-Ray Equipment by C. W. Robertson, Head of Radiological Section, DHSS Scientific & Technical Branch.

Heat Recovery—Some Recent Field Trials by V. E. Skegg, Superintending Engineer, DHSS.

Coal for Health by M. J. Edwards, Director General, Marketing, National Coal Board.

Principals of Air Filtration by P. R. Benson, Regional Sales Manager, AAF Ltd.

Ashrae Testing of Air Filters by G. Watt, Air Filter Service and Supplies Division of AAF Ltd.

Just part of the excellent display arranged outside the lecture hall, which added to the information given during the formal presentations.

The speakers from AAF take questions, with Mr Howorth (centre) in the chair.

The International Federation of Hospital Engineering is now ten years old

In this article Basil Hermon gives a brief survey of how the IFHE started, and pays tribute to the enthusiasm of its succeeding Presidents, who have so ably helped it grow, supported by the unstinting efforts of Bruno Massara, the General Secretary.

Hospital Engineering *is delighted to be the official journal of the Federation. We are always pleased to publish articles with an international flavour. More of these would be very welcome, either direct to the publishers or through the IFHE.*

On page 8 we are also pleased to print a few short reports from member countries about developments in their health care organisations.

IFHE's First Decade

B. A. HERMON CEng MICE FIMech FCIBS FIHospE

Regional Works Officer, South West Thames Regional Health Authority

The benefits of international communication are well known although perhaps not developed as well or as often as they should be. The International Olympics has done a great deal to bring countries together, but it is currently having great difficulty in divorcing itself from politics. It remains to be seen how long international professional and technical communication can succeed without being influenced by national or international politics. 1980 is perhaps a good year in which to review international discussion in hospital engineering for it marks the tenth anniversary of the International Federation of Hospital Engineering (IFHE).

The initiative was taken by the Federazione Nazionale Tecnica Ospedalieri (FENATO) when it organised the first International Congress of Hospital Engineering at the Palazzo dei Congressi — EUR, Rome in May 1970, with about 300 delegates attending from 16 countries. This was a new departure in Hospital engineering at which the feeling of fellowship and common objectives was so strong that a proposal to for-

Scene taken at the opening of the 5th International Congress, held in Lisbon, Portugal, from May 28 to June 2, 1978. This year's congress will be in Washington, USA starting on July 6.

A photograph taken at an earlier Council meeting of the IFHE. This one was in Teheran, Iran, in September 1976.

malise it all through an International Federation was inevitable. The congress agreed the principle towards the end of that week and the details were thrashed out during a three-day meeting of representatives from France, Greece, Italy, Portugal, Sweden and the United Kingdom over Easter 1971.

The Federation was bound to succeed, at least in the short term, because of the enthusiasm and energy of Osvaldo Amato, the first President, and Bruno Massara, the General Secretary, together with the support they had from the other five countries. But could it grow and, if so, would it grow too fast and develop political and communication problems instead of preventing them, or solving them?

In the early days it was not too difficult to arrange meetings of the Council — the numbers were small and the countries were all in Europe. But expansion was rapid and by 1972 there were 15 member countries, 21 in 1974 and 29 in 1979. Council has met formally 13 times from April 1971 to June 1979-in Paris, London, Rome, Lausanne, Bordeaux, Athens, Strasbourg, Lisbon, Teheran, Barcelona and Amsterdam. It meets again in Washington in July 1980. These meetings have been confined to strategy and development of hospital engineering and stimulating contact informally or through congresses and study tours.

The speedy growth of the Federation can be largely attributed to the continuation of enthusiasm of the succeeding Presidents during their two-year term of office — George Rooley, Zissimos Tzartzanos, Jaques Ponthieux and Eduardo Caetano — all supported over these ten years by Bruno Massara, the General Secretary. There is every reason to believe that the Presidents to come will be equally enthusiastic and whilst the rate of further expansion is likely to be slower than it was between 1971 and 1977 there is still plenty of scope for growth.

During these first ten years it is significant that some countries originally joined as Associate Members because there was no national institute or association through which they could apply as full Members and which later formed Institutions/Associations and became full members. Portugal, Switzerland, South Africa, Spain and India did this and their organisations are going from strength to strength.

The membership is now worldwide and communications are more difficult than in the early days. Representatives from the USA and Australasia find it difficult to attend Council meetings between Congresses if they are held in Europe. The necessity for establishing Regional organisations became apparent and the first of these is now operating in South East Asia. The Federation has to hold the balance between encouraging counter-productive splinter groups to form, or having a small inner Council which is formed for geographical convenience.

The Federation resolved to organise congresses every two years, these have been successfully held in Rome, London, Athens, Paris and Lisbon. The sixth Congress will be in Washington in July 1980. The subjects have ranged over planning, building and engineering techniques, maintenance, management and training with no shortage of people willing to pass on information.

The Federation has had a lot of support from the governments in the countries which hosted the five Congresses and their continuing support for the work of IFHE is evidenced by the number of sabbatical periods spent abroad by their native technologists who wish to study the development of hospital engineering.

The Institute of Hospital Engineering in the United Kingdom undertook to produce four issues of their journal *Hospital Engineering* as International Issues each year. The first of these was launched in February 1972 and they have been published regularly ever since. There have been times when these Journals have contained articles of more interest to engineers in the UK and their international flavour has been lost, but this has often been due to the lack of contributions from other countries. Hospital engineers must write of their successes, their failures and their problems if international hospital engineering is to improve its service to the patients.

The Journal is taken by members of the Federation and they are also distributed by IFHE to other countries to stimulate their interest in the activities of the Federation and to expand the communication net. There is much to be done to improve this instrument to international contact.

Some hospital engineers need training which they cannot obtain in their own country, particularly in relation to the maintenance of specialist equipment and in the management of engineering organisations. Many members of the Council were impressed with the facilities available at the Hospital Engineering Centre at Falfield, England, and asked for the possibility of running international courses there to be considered. The result was a seminar "Focus on Appropriate Technology" at Falfield from August 28 to September 14, 1979, attended by delegates from Indonesia, Pakistan, Sweden, Nigeria, Denmark and Iraq. This was an enormous success and consideration is being given to a further seminar in 1981.

There has been close cooperation between IFHE and the International Hospitals Federation which gave some early advice about the formation of IFHE. It is to be hoped that this will not only be continued but that every opportunity will be taken to strengthen it.

There is no doubt that the Federation has gone a long way towards achieving its objectives during its first ten years, and it has done it against the enormous odds arising from world economic situation and political disturbance. It has succeeded in keeping clear of politics even to the point of having representatives from countries in political conflict sitting at the same meeting of Council. International discussion has played a large part in the development of medicine which in turn has been dependent to a great extent on the development of engineering technology, it is logical therefore that international discussion in hospital engineering should continue to grow. In the interest of mankind it must endeavour to stand apart from political influence.

Congratulations to IFHE on its tenth anniversary and best wishes for the future. Perhaps the celebrations in Washington on July 4 will carry over to the 6th when the 1980 Congress opens.

News from IFHE member countries

News from Barbados

Barbados is the most easterly of the Caribbean Islands and is situated at Latitude 13° 4' North Longitude 59° 37' West in the Atlantic. The approximate area is 166 square miles and the highest point is 1,100 feet above sea level. Temperature ranges between 22°C–30°C throughout the year and the island is cooled by the trade winds. The local population is approximately 258,000 people.

Economy

The main sources of income derive from tourism and sugar. Tourism, however, is the main source of revenue, and some 360,000 tourists visit the island annually.

Health Services

The responsibility for providing adequate health services for the entire island falls directly on the Ministry of Health and National Insurance. Treatment in Government hospitals is mainly free, but a small percentage of the beds is reserved for private paying patients.

The main General Hospital is situated within the capital Bridgetown, and has a bed capacity of 593. This hospital was completed in 1964 and has since been upgraded to a teaching hospital. All departments of surgery and medicine are available to the public including Cobalt treatment, physiotherapy and intensive care units. There is also a private general hospital of 120 beds available in the north of the island.

The Psychiatric Hospital has a bed capacity of 665 and is situated just outside the capital Bridgetown. District Hospitals are provided throughout the island and cater for the geriatric and handicapped patients. The total number of beds available is approximately 920. These hospitals are at present being upgraded to provide a modern environment for the patients.

District Medical Services

There is an island-wide medical and dispensary service provided for patients unable to afford private medical attention. Out-patient clinics are held regularly by the Medical Officers who also undertake domiciliary visits to indigent patients, and provide medical care to the patients of the District Hospitals. Upgrading is also being carried out within this service and two new Polyclinics have been completed, with a further five to be completed by 1981–82. There is one out-patient clinic for every one of the 11 parishes in Barbados.

Environmental Health

Public Health Inspectors carry out routine inspections of premises such as restaurants, hotels, supermarkets, factories, swimming pools etc. There is also an Aedes Aegypti programme in operation for the eradication of this mosquito.

Engineering — proposed and ongoing projects

The capital Bridgetown is being completely re-sewered and a treatment plant is being built at an approximate cost of $20m US.

A pulverisation plant is nearing completion for the disposal of the island's refuse. A new headquarters for the Sanitation Service including workshops, offices and parking facilities will be commencing soon.

A new five-storey block housing engineering workshops, wards and an intensive care department for paediatrics is to be built adjoining the General Hospital, to improve the facilities. Three new and two upgraded Polyclinics for preventive and curative medicine will commence soon.

A major step now being implemented is for a National Health Service to be in existence by the year 1981–82.

News from Brazil

Jose Annibal Silva, Engineer

Since the 3rd International Congress of Hospital Engineering in Athens (Greece) I am an Associate of IFHE. Unhappily I did not know about the 1st Congress in Rome (Italy) and the 2nd one in London (UK), however I have received some extracts from the meetings. The 5th International Congress in Lisbon (Portugal) – May 1978 was a success and in that opportunity I could observe the friendship among participants and the interchange of experience concerning the Hospital Engineering field. Since 1974 I have had contact with colleagues from Italy, Portugal, Spain, Iran, France, England, United States, Venezuela and other countries and these relationships are very interesting because I have been able to visit several Health Buildings — and Hospital Equipment Manufacturers in European countries and the USA etc. I have visited the famous Hospital Engineering Centre in Falfield, and some hospitals in London, Paris, Rome, New York, Madrid, Lisbon, Zurich and Boston.

After Athens (1974) I learnt some technical elements about Hospital Planning, Installations and Maintenance and finally on my last trip I went to Caracas (Venezuela) and visited the "Centro de Mantenimiento e Ingenieria de Hospitales" which is part of WHO (World Health Organisation). In 1978 I visited Madrid and Barcelona (Spain) and I was assisted by devoted colleagues at the 5th International Congress in Lisbon (Portugal). I saw there the high level of Hospital Engineering in Spain through its hospitals and the action of "Asociacion Española de Arquitectura y Ingenieria Hospitalaria" with its "Hospital journal" printed in Barcelona.

Regarding Portugal I would like to tell about the annual programs of activities of APEH (Associação Portuguesa de Engineering Hospitalar) which has held severai workshops in Portuguese cities. Really there are many things to see and to discuss concerning health buildings and their planning, construction and maintenance.

People know that each country has its local conditions and therefore it is helpful that one special magazine such as *Hospital Engineering* publishes specific subjects and spreads out research results. It is also necessary to look for other publications about Hospital Equipment, ie Equipment of Health Building and Technical-Scientific Equipment, because there are always problems or doubts concerning specifications of purchase, instructions of operating maintenance and layouts (briefs) of assemblage. In Brazil I and some colleagues have been able to inform much news about "hospitals" because we are Professors of Engineering and Architecture schools and we have been working in Hospital Engineering for Brazilian government and private organisations.

I hope that the IFHE can go on gathering many professionals abroad who are interested in the interchange of information and working for the perfection of hospital units and the welfare of the patients and the hospital personnel.

News from Denmark

The increasing complexity of hospital equipment and installations has stimulated the interest in international exchanges of ideas and thoughts on the problems that hospital engineers have to deal with.

This was why the Society of Danish Hospital Engineers (Sygehus Maskinmestrenes Samvirke) decided to apply for membership of the International Federation of Hospital Engineering in 1978. SMS had little experience in international cooperation. Today they can confirm that the expectations SMS had when joining the IFHE certainly have been fulfilled.

At the board meetings and at the 5th International Congress in Lisbon in 1978 Danish hospital engineers have been acquainted with problems which their colleagues in other countries face. This is also why a number of hospital engineers will take part in the 6th International Congress in Washington this summer.

To get the most benefit from an international co-operation is for member organisations of the IFHE to know something about the membership structure in each other's countries, and that the initiatives taken are to the greatest possible extent reviewed in articles in *Hospital Engineering*, so as to ensure the quickest use of the technology in the maximum number of hospitals.

It is also necessary that the member countries are informed of research and development work in members' fields of activity.

With these comments in mind the organisation of the SMS is briefly outlined below, and some of the activities which SMS has recently initiated are discussed.

Denmark has approximately 150 hospitals. Only a very few of these are privately run. Hospital treatment in Denmark is public and the costs are paid for by taxes.

Hospital engineers in Danish hospitals are, with a few exceptions, members of the SMS. In the last few years the membership has been approximately 150 members. One aim of the SMS is to raise members' technical skills. This aim is furthered by holding meetings and post-qualification courses for members, to meet the necessary and current demand for supplementary training, which the increasing use of complex equipment has given rise to.

With a view to getting the best starting point for an inter-disciplinary dialogue between hospital engineers and hospital administrators the SMS has for several years now co-operated with hospital administrators. Representatives from both organisations take part in each others' annual meetings etc.

Below is a list of some of the arrangements which the SMS has initiated in the last few years:

☐Courses on the safety of electrical installations for hospital engineers, held in 1979. The purpose of these has been to acquaint the participants with the safety aspects of the use of electrical installations and equipment in hospitals.

☐Electromedical courses held in 1979. The aim of these courses has been to teach the participants about electromedical equipment.

☐The SMS annual meeting held in 1979. The meeting lasted four days and the topic discussed was EDP in hospitals. The role of engineers in the implementation and running of computer systems in hospitals was discussed, and also computer programs which already exist or will be developed in the future with a view to optimising working procedures in technical departments in hospitals.

☐A three-day residential course on the production, storage and distribution of medical gases, held in the spring of 1980.

The topic of the 1980 SMS annual meeting will be hospital sanitation. This will in particular relate to:

hygiene in wash rooms — operating theatres;
transportation systems —ventilation;
water/quality of water;
pollution of air when using medical gases.

In addition a number of hospital engineers collaborate on the preparation of recommendations on medical gas systems, such as the risk of explosion in operating theatres, piped medical gas systems, and the environmental factors of using medical gases.

Besides, members of the SMS take active part in the preparation of recommendations on the additional protection of electrical installations in hospitals.

These are tasks initiated by the Danish Hospital Institute, which is a research and development institution set up by the Danish Government, the Association of County Councils and the City Council of Copenhagen.

News from Iran

The annual general meeting of the Iranian Society of Hospital Administrators has been held at the School of Public Health, Tehran University and reported by the official Iranian newspapers.

The President of ISHA announced that the membership of the Society is now open by election to all hospital engineers, architects and experts. The reorganised society under the presidency of Dr K. Majidi, PhD, MPH will be concerned with various aspects of the National Health Service in the country.

Mr M. Soheili, FIHospE has been elected as a member of the executive council of ISHA for three years. It is proposed that the title of the Society should be changed in order to welcome all the specialists who have interests in hospitals.

Mr Soheili is representing the Islamic Republic of Iran in the International Federation of Hospital Engineering as an associate.

News from the Netherlands

The name of our Association, which was founded on August 26, 1947, is "Nederlandse Vereniging van Ziekenhuis Technici" (NVZT), which means "Dutch Association of Hospital Engineers". (Please note Engineers and not Engineering.) According to our regulations, members can only be managers of technical departments, who have a direct responsibility to the board of directors, or technicians with a bachelor's degree.

Our Association has about 300 members, and is divided into nine regions. The members of each region meet once every two months. National activities consist of a one-day congress and a two-day congress, during which the annual members' meeting is held. Apart from these activities, different members of our society participate in several committees, concerning normalisation, safety, energy, etc.

The Dutch Association has offered to organise the 1982 Congress of the International Federation of Hospital Engineering. This congress will take place from May 9-15, 1982 in the Amsterdam Congress Centre. We count on 1,000-1,500 persons attending this congress. Two committees have been installed, one to handle the overall organisation, and one for the congress' content.

Colleagues who wish to help by delivering a Paper may contact the secretary of the Dutch Association, Mr Gaston E. Lam.

We would like to ask the IFHE members to keep the May 9-15 1982 open. It is the intention of the organising committee to send a personal invitation to all IFHE members in all countries. That is the reason for our request to all secretaries in all countries to send a list of the addresses of their members to our secretary, Mr Gaston E. Lam, Prinses Ireneweg 7, 7433 DD Schalkhaar, Holland.

In conclusion make a note in your diary for the 1982 IFHE Congress in Amsterdam.

This paper was given at the International Congress of Hospital Engineering in Lisbon in 1978. Mr Rahat has an engineering/management/co-ordination consultancy in Jerusalem.

Integration of Architectural, Structural, Mechanical and Electrical Systems in Hospitals

E. RAHAT

Civil Engineer Jerusalem Israel

Introduction

Ideas in hospital design throughout the world are undergoing continual and dynamic changes. Concepts of hospital design must respond adequately to the problems created by new demands, new needs, new equipment, new services and new medical activities (ie day care activities). Such programs can be met by a proper integration of architectural, structural and electro-mechanical systems. This integration is reflected, and can be implemented, by setting rules for design and by arranging electro-mechanical services and distribution.

The electro-mechanical distribution system in a hospital can be compared to the vital veins in the body. Do we want to see this vital system trapped above ceilings? Or do we prefer to have simple access to it? Do we intend to squeeze the system in a shaft? Or do we prefer to see it in the open?

Needs of Hospitals

Design

Need for up-dating, adaption and modification with a minimum expenditure of time and money;

Need for fast designing;

Need to improve hospital performance;

Need to absorb new ideas, concepts and systems;

Need for a real integration of architectural, structural and electro-mechanical services.

Construction

Need to build a health care facility in a short time;
Need to simplify construction;
Need to allow revisions during building in an easy manner.

Maintenance

Need for accessibility of equipment and distribution systems;
Need for a separation between the medical function and the mechanical systems;
Need for a saving on maintenance.

Development

In order to facilitate the growth and development of a hospital in the most logical and least costly way, the work of changing in one area should be limited without affecting another area.

Interstitial Space System

The interstitial space should contain and channel all piping, air conditioning ducts, electrical wiring, communications systems, transportation systems and other utilities that are necessary for the operation of a hospital.

The distribution system is organised between functional floors. A vertical tower system, rather than a large number of scattered shafts and spaces, connects between the interstitial spaces. It is preferable that the interstitial space should provide a distribution function only. Therefore, no machinery should be situated there.

Elimination of equipment in the interstitial space allows for optimal utilisation of the area. Equipment should be installed in special bays at the ends of the building. These bays are organised as small machinery rooms. For this purpose, the bays utilise the full height of the floors. The layout of equipment in modular bays provides a highly effective electro-mechanical service, which improves considerably availability and reliability. The height of the occupied floor can be reduced to 2.70 metres instead of 3.50 metres as required by the conventional system.

The interstitial space should be of a sufficient height (2.20-2.40 metres) to allow access for maintenance and service personnel, without disrupting activities above or below. The space should also preferably be of a long span type.

Greenwich Hospital in England pioneered in the use of interstitial spaces. However, the system developed greatly in the United States. At first, the floors of the interstitial spaces were not poured with concrete or any other solid material. Instead, catwalks were provided within the space in order to allow access for maintenance personnel.

The omission of a solid floor was due to budgetary factors. The disadvantages caused by this omission were: (1) staining of the suspended ceiling (resulting from leaks), (2) acoustical disruptions, and (3) lack of direct access to each pipe or duct.

Experience has shown that it is most important to have a solid floor which provides accessibility and protection against fire, acoustical breaches and leaks while permitting the penetration of the electro-mechanical services to the occupied floor.

Advantages of the System

Flexibility

The use of interstitial space provides a high degree of flexibility which has a most beneficial influence on the following:

Interior space arrangements
Changes in design
Absorption of new ideas and systems
Simplification of design
Design
Changes during and after construction. These changes can be made more easily, quickly and economically because of the ability to work inside the space. Connection and disconnection of existing systems, as well as the introduction of new systems can be undertaken without disruption.

All of the above mentioned items can be handled in a more economical and time saving manner by the use of the interstitial space system.

Economics in Design and Construction

The nature of the interstitial space concept allows an early start of construction. Tendering for construction can commence earlier without being delayed by deciding on detailed plans of electro-mechanical systems.

Overlapping of the design phase and the construction phase saves time, while allowing for updating of design and systems. A 'fast-track' system (design through construction) can be incorporated.
Separation of electro-mechanical works from the finishing trades of the building reduces labour costs.
Working in an open space as opposed to a shaft results in a substantial saving of labour in all systems.
Height of partitions in a functional floor is less than in a conventional system.

Quality of Work

Separation of electro-mechanical works from building finishes improves the quality of the installation.
The organised open space improves the result of the quality of the installation.

Maintenance

Easier access to all building systems, utilities and electro-mechanical components increases the efficiency and cuts the costs of hospital maintenance.
Most of the maintenance can be done in the interstitial space, thus reducing the need for maintenance staff to work on occupied floors.
Locating a problem in the electro-mechanical system is easier and faster.

Miscellaneous

Elimination of the majority of the usual vertical shafts (retaining only a few large towers that are essential), results in considerable reduction of fire hazard.
Horizontal interstitial space which is connected to a service bay at the end facilitates easy heat recovery.

Cost

Ceiling height in the interstitial space system is about 5.40 metres (as against 3.75 to 4 metres in a conventional design).

The floor that is poured for the interstitial space is a light floor. The function of the shell of the interstitial space (or envelope) is of a less costly type. It is also true that the floor of the functional zone must be calculated for the extra load of the hung systems and, sometimes — depending on the structure — for the load of the interstitial space floor itself which might be suspended from the functional floor.

On the other hand, in the conventional design, the lack of systematic arrangement of areas has a negative impact on the structural design and increases the amount of steel in the structure.

It may be concluded that the initial construction cost might be increased by about 60%. However, relationship between cost of structure to total cost of a hospital is about 20% to 25%. The real increase of the cost is therefore about 12% to 15%.

In evaluation of cost, one must take into consideration not only the initial cost of a system, but the life-time cost as well. One must also take into consideration the influence of sub-systems, for instance:

Partitions are built up to the interstitial space floor to a standard height of about 2.70 metres.
Construction can start earlier.
Probable reduction of cost of electromechanical works.
Better quality and better results.
Minimising cost of changes.

All of the above contribute to shorten the gap between the cost of a conventional system and an interstitial space system. It can be concluded that the difference in cost is much less than is widely believed.

The Impact of Changes

Research was carried out in the United States in order to determine the pattern of changes in various functions of the hospital. It is very difficult to categorise these changes. Certain hospital facilities and functions can be adapted to changes more readily than others. For example, disruption of the functioning of the surgical and intensive care unit is completely unacceptable. However, laboratories, X-Ray facilities, etc, can tolerate disruption to an extent.

There is a trend of thought that considers that nursing units do not require interstitial spaces. General nursing areas tend to be subject to minor structural changes and have moderate tolerance to disruption. Therefore, interstitial space may not be cost effective in the nursing area. In my opinion, interstitial space is justified in hospital wards not only because of rapid changes that may occur in the wards due to conversion (eg from regular ward to an intensive care unit), but mainly because the requirements of a rational maintenance system must be satisfied.

Structure

It is very important to integrate the structure into the total concept. Structure should meet the following requirements:

Modularity
Simplicity
The longest possible span structure
The maximum omission, wherever possible, of vertical elements
Maximum ease of penetration of floors
Maximum fire resistance of the shell of the service module

Design Examples

Shaare Zedek Hospital in Jerusalem, Israel

The main building has ten floors. There are two mechanical spaces of full height — one above the medical treatment facilities and one below the wards. The mechanical floors provide not only for distribution but also for equipment (A/C units are scattered throughout the floors). Thus, equipment is not arranged in a systematic way; the large number of columns and shafts interferes with the optimal utilisation of space.

Jaffa Hospital, Israel

A big advantage in the design of this hospital is that a long span type of steel structure is used. This allowed for economy in cost and flexibility in interior layout, thus providing the conditions for the integration of architectural and structural concepts. However, because an insufficient number of interstitial floors were included in the structure, full integration of the electro-mechanical services was not possible. This compromise in the concept of total integration obviously has disadvantages in design and maintenance costs.

Loma Linda Hospital in California

In the United States extensive and comprehensive research has been developed and sponsored by the Veterans' Administration. The philosophy and idea of the full integration of the electro-mechanical systems was approached in the Loma Linda Hospital. The basic element of the Loma Linda system is the design of the service module. The service module integrates functional and service spaces. The service module consists of a functional area, a service bay and a service zone (interstitial space). The system is based on an assembly of service modules each 1000 to 1500 square metres which are serviced independently. The functional area houses hospital activities. Vertical elements are limited or eliminated (depending on structure). Shafts, fire-rated partitions, towers and other vertical elements are at the perimeter of the zone.

All vertical services are concentrated within the service bay. It houses the equipment and is the point of departure of service distribution. The service zone (interstitial space) accommodates the horizontal distribution of all electromechanical and communication systems. Distribution of all electromechanical services in the interstitial space is prearranged so that every system has its right of way and crossing without interference with the other systems. Spaces of course allow for future systems as well.

Let us look for a moment at the Loma Linda concept from the point of view of two main subsystems (the shell and the services) which together constitute about two-thirds of the cost. The shell includes structure, floors, ceilings, partitions, etc. The services include HVAC, plumbing, electrical communications, etc. The concept distinguishes between fixed and adaptable components.

Fixed components are those whose introduction, modification or removal require major building construction. Therefore, they are designed for sufficient capacity to meet project changes. Fixed components include structural elements, main HVAC ducts, ceilings, etc. Adaptable components are those whose modification, alteration or removal don't require a major building construction like partitions, suspended ceilings, local distribution systems, etc. The concept of permanent and adaptable components provides the framework for greater flexibility in the hospital.

Conclusion

The interstitial space system contributes to hospital needs for adaption, modification and modernisation. The idea of interstitial space utilisation contributes to the needs of the hospital in respect to time saving and money saving in respect of facilitating modernisation. The advantage of the interstitial space concept in regard to installation cannot be contested.

The use of interstitial space itself will not give full advantage unless it is fully integrated at all levels of architectural, structural and electromechanical systems.

References

Agron, George. **Research and Application in VA Hospital Systems**,
Stone, Marraccini and Patterson, Architects

Jaffa Hospital, Israel. Architect: A. Jaskey, Tel Aviv. Project Manager, Deputy Chief Architect Public Works Department: M. Y. Turetz. Chief Construction Engineer, PWD: Eli Ron.
Shaare Zedek Medical Centre, Jerusalem, Israel. Architects: D. A. Brutzkus and J. Schonberger. Project Management, Coordination, Supervision and Consultants: E. Rahat.

Planning and Execution of Preventive Maintenance in Hospital and Industry

R. O. POPOOLA ONDip AssocIHospE AMIE
Engineering Department, University College Hospital, Ibadan, Nigeria.

Introduction

The amount, complexity and cost of engineering plant, services and equipment and building works in industry and modern hospitals, (and their place in medical treatment) point to the need for systematic examination and routine maintenance to be done in accordance with a programme, devised to suit the individual industry and hospital.

This paper describes a system of planned maintenance for engineering services. A major objective of this system is to ensure that more than one trade can carry out work within a department simultaneously. In this way the minimum amount of inconvenience is caused. The paper describes how this can be achieved in respect of engineering services; it is incumbent upon the hospital to ensure that the major parts of the engineering servicing programme are carried forward with building maintenance wherever possible, so that both building and engineering maintenance works involving several trades can be carried out together.

Preventive Maintenance

No matter to what degree of refinement a Preventive Maintenance programme is developed, all of them contain basic activities. These are periodic inspection of plant assets and equipment to uncover conditions leading to production breakdown in industry and inadequate services to the hospital. The upkeep of plant to sterilize the conditions or to adjust or repair such condition while they are still in a minor stage.

Preventive Maintenance

The need for Preventive Maintenance in the hospital and industry can be classified as follows:

Fewer large-scale repairs and fewer repetitive repairs, hence less crowding of maintenance manpower and facilities.

Lower repair costs for simple repairs made before breakdowns, because less manpower, fewer skills, and fewer parts are needed for planned shutdowns than for breakdowns.

Postponement of elimination of cash outlays for premature replacement of plant or equipment because of better conservation of assets and increased life expectancy.

Less standby equipments needed, thus reducing capital investment.

Decline of maintenance cost — labour and material — or assets items in the programme.

Identification of items with high maintenance costs, leading to investigation and correction of causes such as (a) misapplication (b) operator abuse, or (c) obsolescence.

Shift from inefficient "breakdown" maintenance to less costly scheduled maintenance, hence better work control.

Better spare-parts control, leading to minimum inventory.

Better industrial relations because production workers don't suffer involuntary lay-offs or loss of incentive bonus from breakdowns.

Greater safety for workers, and improved protection for plants, leading to low compensation and insurance costs.

Inspection Frequency

For inspection of plants and equipments we need to consider the age, condition and value. Older and poorer equipment need more frequent servicing. But if ready for the junkpile, or soon to be obsolete, it may be cheaper to inspect on a skeleton basis or not at all.

On severity of service, more severe applications of identical equipment require shorter cycles. In a process plant, you might need to inspect a critical pump everyday. On safety requirements we need to allow a wide margin for safety. For example, one plant inspects the solenoids operating the clutches on presses every two weeks.

On hours of operation, many manufacturers suggest frequency cycles based on an eight-hour day, others on usage (such as mileage). Building and seasonal services operate on a calender basis, such as the washing down programme in the hospital. Sometimes two bases are used, which ever comes first. For example, sump cleaning may be needed when changing operation or at least every thirty days.

On service records, there is a need to dig out whatever data on cost performances we have equipment records, down time reports, routine maintenance schedules. They are excellent clues not only as to what to inspect for, but also how often. Maintenance work orders need to be sorted out on individual machines or functions. If you don't already have any equipment records, then analyse the nature of repairs.

On other plants, review the list of those preferably in the same industry, but merely as a guide. It is necessary to inspect some equipment more frequently than others.

Inspection Schedules

Routine Upkeep: This type of work is done at regular short itervals — adjusting, lubricating, cleaning — while equipment is operating or productively idle. This also includes care of non-productive items such as lighting, heating and filters.

Periodic Inspection: Cover work at prescribed intervals on equipment that is running or shutdown — visual inspections, teardown inspections, overhauls, scheduled replacement or parts.

Contingent Work: This includes work at indefinite intervals when equipments is down for other reasons eg inspection of gas burners when relining a furnace.

Obviously, the more Preventive Maintenance work you can squeeze into the contingent category, the less costly it will be. To ensure that the work will be done, you schedule such items on a 'which-comes-first' basis. This is done by listing these Preventive Maintenance items on your work-planning sheet kept for repetitive maintenance jobs (such as relining a furnace). Or by protecting yourself by a 'tickler' item timed for the maximum allowable period between inspection. Along the same lines, you can pile up a list of repair jobs that have been uncovered by running inspections and which can be deferred until the next shutdown, for example, repairs on boiler plants.

In scheduling Preventive Maintenance of the nature of routine upkeep or periodic inspection, these are good goals.

Handle them on the day shift, preferably, to minimise overtime, but don't overlook the possibility of greater worker effectiveness on overtime basis overbalancing the greater labour cost.

Distribute them over the year to even up the total maintenance work load, but remember to schedule Preventive Maintenance work for slack seasons whenever possible.

Shut for least productive down time. You might do this by scheduling Preventive Maintenance during set up time, or even shifting the job to an off shift.

Operating foreman agree on suggested schedules. They are not told, they are consulted on dates, they know co-operation pays.

Maintenance executive sets up a tentative schedule for a year, circulates it to production heads for correction and approval.

Maintenance department sends advance notice to production as each item comes up, showing reason for need of Preventive Maintenance and estimated down time.

Maintenance central planning group sends weekly report summarising all units due for maintenance shut down on each item, also degree of urgency, what may happen if work cannot be done as scheduled. Later both interests agree on schedule at a weekly meeting.

Paper Work for Preventive Maintenance

Minimise the number of forms and entries. Do not try to record information just because it is nice to have. But do not eliminate data to the point where records cannot be interpreted and thus lose their usefulness. In any operating plant, such as the NIPOL Plastic Industry, Ibadan, Nigeria, it pays to show monthly totals of maintenance costs and running hours in all its machines — equipments records. Such data may be valueless to you, but omission of small costs because they are a bother might mislead on appraising machine performance. Most plants include total labour and material costs on an equipment record for every job, and note nature of job, and number. If more details are wanted, they can refer to the 'Completed-order' file.

Integrate the Preventive Maintenance system with other maintenance paper-work procedures. A good Preventive Maintenance will not start alone, it has to be meshed with regular plant maintenance and engineering. This in particular ties in with the paper-work flow. Methods and routes for Preventive Maintenance work orders, time reports, material requisitions, and cost accumulations should coincide with regular maintenance procedures.

Make sure costs of all primary Preventive Maintenance inspection activities are accounted for. Only this way you can prove to yourself and higher management what the exact costs are, and how well you are doing. The degree of breakdown depends on plant operation. In a plant requiring full-time inspectors for single functions such as cranes, buildings and corrosion, separate accounting is a foregone conclusion. Where rotating inspectors are used, labour hours in lump sums, for major inspection categories such as machinery, electrical utilities, and buildings may do. Repairs originating from Preventive Maintenance should follow normal workorder routine. If these costs are ever needed to prove your programme, you can earmark each order with prefix or suffix (Preventive Maintenance, for example), for quick extraction from the whole pile, or use a similar code in the 'requested by' column on the work order.

For cross-checking the performance of Preventive Maintenance, there is a need for the arrangement for a periodic control report, say, once a week or month. Such a report might summarise the number of inspections schedule, completed, uncompleted (and why), and the number of work orders originated by Preventive Maintenance, and number completed. As the programme gets going, the number of work orders will slowly drop and smooth out to a fairly even flow. Also consider using this same control report as the basis for keeping management posted in Preventive Maintenance.Include it in regular report, that is a good practice to send to higher management on all maintenance activities.

The Preventive Maintenance Programme

No Preventive Maintenance programme, however carefully planned, can remain static if it is to be effective. New manufacturing concepts, new management techniques, and new tools require the periodic checking and updating of its inspection. Here are pointers for refining a Preventive Maintenance programme.

Avoid Over Maintenance

A good Preventive Maintenance programme is not rated by the per centage of equipment it covers. In fact, repairs as needed (instead of Preventive Maintenance) are usually less costly for equipment that operates at a low hourly capacity. To find the optimum level of application, chart the cost of Preventive Maintenance, repairs, and production losses at various levels of Preventive Maintenance activity. The optimum level is at the point of the lowest sum total of these three costs. This level should be ascertainable for a single machine, a cost centre, or an entire plant.

Get Accurate Costs

To arrive at the optimum level, the maintenance engineer must have true costs. They must be segregated for regular repairs, Preventive Maintenance activities operating maintenance, downtime losses, improvements, and new work. And they must permit cost breakdowns by machine units and single jobs. Without such detailed costs, it is impossible to appraise the value and extent of Preventive Maintenance application. To this end, if possible, get a leg on any available time on the Company's mechanical or data processing equipment to produce detailed cost analyses otherwise difficult or impossible to get.

Check Inspection Frequencies

At the start of Preventive Maintenance programme, the rule is to over-inspect to play safe. If a machine record shows no maintenance cost other than Preventive Maintenance inspection, consider extending the interval. Moreover, changes in operating conditions and equipment, also improvements in inspection measures, may justify a stretch-out. Check the frequency of all inspections requiring shutdown or dismantling, and explore for an easier way to inspect.

Provide Specific Craft Inspection

These should be kept undated, they ease the load of supervision. Secure from suppliers complete parts and service manuals for each piece of equipment. Develop procedure sheets to describe how to handle all complex Preventive Maintenance jobs. Insist that craftsmen read these sheets at the start of every job. Develop checklists for each type of equipment; show inspection tools needed. Review the checklists periodically for omissions. Encourage corrections by craftsmen and operators. Check these lists against all breakdowns for possible improvement.

Adopt Repair Codes

These are usually four to six-digit accounting codes that show on each maintenance order (Preventive Maintenance or repair) the machine and part work on, nature of the repair, probable cause, craft time, and material and labour costs. They are invaluable for discovery and analysis of maintenance trouble. Periodic review of invaluable repair costs will highlight high cost items and show need for Preventive Maintenance changes (corrective maintenance) redesign.

Use Modern Diagnostic Tools

Inspection can be simplified and speeded up with special tools such as dial indicators, vibration analysers and non-destructive ultrasonic and X-ray apparatus. Operating equipment can be continuously monitored by malfunction detectors, with alarms or cut-offs, for pressure, temperature, and wear limit. Paint and wall thicknesses can be accurately measured ultrasonically, and erosion detected by corrosimeters. Scores of automatic sensing, measuring, or control devices are finding wide Preventive Maintenance application.

Apply Industrial Engineering Techniques

Set time standards for repetitive jobs. Develop procedures for inspections and overhauls that show work methods, work sequence, tools, materials, and accessory equipment. In a teardown, do only what is necessary at standstill, to minimise downtime.

Use the critical path method for scheduling jobs over thirty to fifty hours. Co-ordinate inspections to minimise the number of visits and travel time. Preinspect new parts when received to avoid delays from missing or defective elements. Apply work simplification principles to all jobs.

Utilise Statistical Aids

Learn the types of equipment failure curves (wear-out, random) and how they influence the Preventive Maintenance programme. For example, parts without definite wear-out characteristics or those in random failure category do not profit from Preventive Maintenance. Study wear patterns of equipment; keep logs that help determine the fewest inspection or overhaul cycles for adjustment or replacement.

Design for Low-Cost Maintenance

This is the first step in minimising the Preventive Maintenance workload. Designed reliability (meantime to point of failure) reduces frequency of availability. Policy of maintenance prevention requires examination of maintenance cost in purchase-cost justification. All new equipment and alterations are checked for excessive maintenance needs. Items more likely to fail must be made accessible, easy to repair or replace, as by modules or plug-in units. This maintenance prevention policy will prove the best way to achieve high equipment availability in integrated or automated production lines.

Conclusions

The system has been described in this paper step by step to facilitate understanding of the procedures in its setting up and subsequent operation. The introduction of planned maintenance will probably mean greater pressure of work on the engineering department in the first year, but thereafter the pressure will be less than before and the benefits of an organised system of maintenance will amply repay the effort of introducing it.

This article outlines the education and progress of a young engineer. It is published here as a recognition of the work of the individual concerned, and to encourage others who are on the same path.

Profile of a Young Engineer

J. BOLTON
Chief Works Officer, DHSS

Michael Ralph Humphries, at present a main grade engineer with the South West Thames Regional Health Authority, was born on November 27, 1952 in Market Harborough, Leicestershire where he received an education in the local County Grammer School, leaving with the usual number of 'O' level passes.

He served an apprenticeship to a local company, Spencer and Sons Limited, and after two years was transferred to the drawing office where he completed his training as a draughtsman.

He decided that he was unlikely to get very far in Market Harborough and so early in 1974 he moved to London to work as Assistant Hospital Engineer for Lewisham Health District which was at that time under the control of Mr C. Hellier, the Group Engineer. He served on site and at district headquarters, and then became interested in Building Services from the maintenance and operations aspect. During his service with the Lewisham Health District, he was awarded three endorsements to his Higher National Certificate.

He then applied to the South East Thames Regional Health Authority for sponsorship on the Environmental Science Degree Course and was accepted. In July 1975 he was awarded a First Class Honours Degree.

He is now employed as a Main Grade Engineer at Regional Headquarters and has been involved in the design and specification of a range of Health Service projects, including Health Centres, Residencies, Maternity Homes, Laundries etc.

During his studies, he undertook research into the thermal performance of buildings. Part of the results of this work was recently published in *Heating and Air Conditioning.*

John Bolton, Chief Works Officer of the Department, who is a member of the Worshipful Company of Fanmakers, recently had the pleasure of meeting Michael at a Company Dinner; because, prior to the Dinner, Michael had been honoured by being presented with the Bronze Medal Prize by the Master of the Company as the Best Student of the Year in the Fan Engineering Section.

This is an annual award presented to the student who obtains the best results in Fan Engineering. The section is now considered as Environmental Plant and embraces Fan, Duct and Air Conditioning Systems along with the attendant Plant such as chillers, coils etc. The student is selected by merit by the Principal of the Faculty on advice from lecturers in the appropriate subjects and the award is presented at a Dinner held at the Company's Court at St Botolph's within Bishopgate.

As may be imagined John Bolton was extremely proud and pleased that an officer from the Health Service had received such a coveted award. He has described Michael as a fine young man typical of many such entrants to the Service — a view shared by Mr Eric Davies, Regional Engineer to South West Thames Regional Health Authority.

Mr Cecil-Wright is a Director of A. T. Kearney Ltd, Management Consultants, and Mr Ross is Area Works Officer, St Helens and Knowsley Area Health Authority.

Estate Maintenance Condition Monitoring

J. J. CECIL-WRIGHT AND C. ROSS

An effective system for monitoring the maintained condition of buildings and equipment has been developed and proved by the St Helens & Knowsley Area Health Authority works organisation in conjunction with management consultants, A. T. Kearney Ltd.

Most Area and District works officers do not have any means of keeping an up-to-date knowledge of the present maintained conditions of the estate for which they are responsible. They are thus unable to base their plans for maintenance expenditure on informed predictions but must rely on a combination of past-practice, and limited personal knowledge and assessment.

Many senior technical officers have recognised that their historical and subjective methods for predicting maintenance expenditure fail to make the best use of maintenance resources either locally or nationally and result in waste and poor standards of maintenance in some areas.

Several attempts have been made to provide a cost effective and realistic method of providing an up-to-date assessment of the maintained condition of buildings and equipment. There are systems in use in some parts of the country which tend to rely on sampling techniques or highly subjective judgement and are thus open to criticism as being superficial or inconsistent.

At St Helens the system has been shown to be:

Largely objective (proven by two persons of different technical skills making a series of checks in the same areas and producing the same results).

Economical to apply to the complete estate (tests showed that it required about $5\frac{1}{2}$ hours to monitor 1000 cubic metres of space in an average health building.

Objectives

The objective of the programme was to enable the St Helens and Knowsley Area Works Officer to assess the practicability and usefulness of a Maintenance Condition Monitoring Procedure.

Specifically the procedure was to have the following features:

It must provide an objective assessment and report of the condition of each of the separate assets of the hospital.

It must provide the facility to record estimated costs of repair or replacement against each asset or item.

It must also provide facilities for recording estimated dates by which necessary maintenance should be considered against each item in order to provide for forward commitment of resources.

The assessment of condition must be able to be done effectively by personnel such as assistant engineers or building officers.

Scope

The study was carried out at the St Helens Hospital. It included all the buildings, plant, equipment and grounds, roads and carparks which were the responsibility of the Area Work Organisation.

System Hypothesis

The system is based on the hypothesis that everything which comprises the structure or contents of a health building or estate should perform the functions for which it was required. If it does not perform these functions it is that factor which is relevant, and not the reason behind it.

Development of Hypothesis

From the initial hypothesis there arise a number of considerations of 'facets' which are described below.

Function

Does the item perform the function for which it was originally intended?

From the point of view of the user or occupier the reason for an item being defective is of little importance compared with the fact that it is defective. However, in assessing the maintenance need the evaluator should note the reason for malfunction, if evident, and process the information if corrective treatment is required.

Structure

Is the structure of the item sound or is it such that it will lead to malfunction of the item?

Although an item may be functioning in a satisfactory manner, it should be apparent to an evaluator that its condition is not likely to remain satisfactory and will lead to malfunction.

Surface Condition

Is the surface condition of the item satisfactory?

All surfaces which are painted or given other similar kinds of surface treatment have been so treated for one or more of the following reasons:

The surface needs to be preserved or protected.

The surface must be capable of being easily cleaned.

The surface must be pleasing to the eye.

In assessing maintenance need this facet should be considered separately from cleanliness.

Cleanliness

Is the item maintained to an acceptable standard of cleanliness?

The cleanliness facet is only assessed when it is the responsibility of the building and engineering divisions. The cleanliness of many items is for example, the responsibility of domestic or catering departments.

Safety

Is the item safe or is it in a condition which could be hazardous to people or other items?

The safety facet must be the main consideration when assessing the maintenance of items.

The best possible condition is for every item comprising a health building to be functioning perfectly, in the 'as-new' condition and absolutely safe. The worst possible condition must therefore be for every item comprising a health building to be not functioning, and in a totally decayed and dangerous state. The normal condition of a health building will lie somewhere between these two extremes.

It is in the determination of where, between these two extremes, that subjective opinion has in the past, made maintenance quality evaluation difficult, uneconomical and unreliable.

Systems Requirements

From the above it is possible to describe various requirements with which a system of evaluation should conform. They are:

It is necessary to assess each asset or item solely on its condition and that no account should be taken, when assessing the condition, of such considerations as:

The probable cost of repairs or replacement.
The planned life of the item.
The current need for the item.

We should minimise as much as possible the opportunity for introducing subjective opinions when assessing the condition of each item.

We should attempt to provide some indication of the trends of the maintained condition of health buildings by recording and comparing year by year with previous recorded conditions.

In order to achieve consistency of results between different evaluators and to agree a meaningful evaluation of the quality of maintenance, the system should have an agreed categorisation of assessment. Thus when the condition of an item is being recorded, it should be sorted into one of a limited number of categories, regardless of any other consideration. It is only when the overall assessment of the maintained condition is being made that it must be factored by the importance of the item, its position within the health building, and the degree of inconvenience, disruption, or danger, that the condition will cause.

Resulting from these basic thoughts was the conclusion that a realistic system for evaluating maintenance needs should have the following further requirements:

All separately definable zones of the health building (eg wards etc) should be called Assets. These assets should be registered together with their basic description.

All assets should consist of one or more items which when combined form the asset.

When evaluating the maintenance condition of an item the maximum number of facets of maintenance assessment which would normally apply would be:

Function.
Structure.
Surface Condition.
Cleanliness.
Safety.

Nearly everything concerned with maintenance of buildings, engineers, groups and equipment should be able to be categorised within these facets.

There should be no more than four degrees of condition applying to each facet and only two for safety. Basically these degrees would represent:

Perfect or as-new.
Imperfect or minor faults.
Very poor or major faults.
Inoperative or totally decayed.

For safety:

Could be dangerous under some circumstances.
Dangerous conditions exist.

The surveys should be so structured that each officer evaluating an area or piece of equipment would look at the same features and categorise the condition in the same way. This would require:

A series of standardised survey forms.
A series of written descriptions of each degree of each facet for all different items which are to be surveyed.

The decision to be made by technical officers should be in deciding which degree of each facet applies to the item being surveyed.

Subsequently management must assess the maintenance needs against available resources. The criteria affecting this assessment would be:

The assessment of the condition of the items/asset.
The importance of the item/asset to the function of the health building eg
Critical.
Important.
Normal.
Unimportant.
The impact of the substandard condition.
Safety Considerations.

It should be possible for the above system to cater for all possible buildings, grounds and engineering maintenance assessment as defined by the five facets and four degrees outlined above.

Records

The specification of the system indicated the need for certain records:

Asset Register

This is a register containing details of all the assets which are separately registered.

Master Survey Sheet

This is the Master Survey Sheet on which are recorded all the items comprising an asset.

Survey Record Sheets

Survey Record Sheets are used for recording the conditions of the items in an asset.

Survey Instruction Sheets

Survey Instruction Sheets which provide detailed descriptions of the various possible conditions of a large number of typical items and are used for the purpose of training evaluators and establishing a consistent approach between different evaluators.

Operating Procedures

The Maintenance Condition Monitoring system involves three stages of operations:

Creating a Register of Assets.

Surveying the Estate to provide the information needs on the number of items to be monitored in each asset, and creating the necessary Master Survey Sheets.

Inspecting the estate to determine maintenance condition and needs.

Stages 1 and 2 are once-off exercises which, having been done, only require up-dating for changes in use, increased or decreased facilities, and equipment.

Stage 3 is the routine inspection procedure which can be carried out at selected intervals.

Procedure

Development Team

This programme was carried out by an Assistant Building Officer and an Assistant Engineer from the St Helens and Knowsley Area Health Authority Works Organisation. They were trained and guided in the development and operation of the procedure by a consultant from A. T. Kearney Limited.

Development and Testing

After training the two Technical Officers continued to work on the development and testing of the most appropriate paperwork and systems for several weeks.

The work consisted of development of suitable forms, the testing of various surveying methods and the checking of the criteria for assessing the condition and criticality of each item.

Checks were also made on the amount of time required for the operation of the system.

Findings

Asset Identification

The area works organisation had previously prepared a complete room schedule for all the areas of the Hospital.

Each room or area of the hospital was identified with a number.

The use of this schedule as the means of identifying assets ensured that the building and engineering officers both identified assets in the same way and with the same numbering systems and also that they had a means of checking that everything was covered.

Master Surveys

All the master surveys were carried out by the two technical officers. The length of time required for each survey was recorded in order to provide date for estimating the investment time required for extending the scheme to other areas and hospitals. (See *Figure 1*).

The completion of the forms was assisted by preprinting repetitive data on to the forms.

Condition Surveys

When conditions were judged to be 'C' or 'D' in any of the facets the importance of the need for corrective action was judged according to a specific list of priorities.

Minor repairs and those typically done within the authority of the Hospital Engineer/Building Officer were then listed on work orders. Repairs of a similar nature but occurring in several instances or areas were accumulated to form the basis of a collective job.

Extensive or costly repairs were reported for inclusion in the forward commitment of the Works Programme.

Upgrading

This programme is mainly concerned with monitoring the maintained condition of existing assets. However when a technical officer is judging 'Maintained Condition' he is also assessing the need for upgrading the asset due to the deterioration or obsolescence of equipment of buildings. This enables the officer to keep up-to-date on the upgrading needs of his whole estate.

Survey Time

The time required to complete both master and condition surveys was compared with the complexity of the asset. This was calculated as a function of the volume of each asset and the number of separate areas within it.

The analysis showed that there was a co-ordinated relationship between 'complexity and survey time requirements' (see *Figure 1*).

In general for buildings of average complexity one would budget on 1.2 hrs of each of a building and engineering officers' time per 1000 cubic ft to carry out the master surveys. Condition surveys take about twice as long to complete.

Both surveys also require clerical work and this involves about as much clerical time as survey time.

Survey time can vary by as much as plus or minus 50% from the average. according to the complexity of the area under survey.

Numerical Assessment

A mass of data is accumulated as a result of the condition monitoring surveys. It is simple and practical to extract from it those items which require attention, but it is difficult to assess the overall conditions of the hospital except in a very general sense. It would be particularly difficult to provide a proper comparison to two different buildings. Alternative methods of achieving a summary or comparative system were considered. A numerical system called the Maintenance Condition Quotient System (MCQ) was designed and included as part of the system.

During development, the Maintenance Condition Monitoring System was found to be an effective and sufficiently objective system for determining the condition of maintenance of a hospital consisting of a variety of buildings ages and types.

A major conclusion was however that it formalised the routine inspection procedure which should be part of a technical officers normal activities. This inspection combines the need for Preventive Maintenance checks and forward Planning of Resources with an objective numerical assessment of conditions which can be used for comparisons of buildings or measurements of progress towards planned targets.

At St Helens the system is being introduced throughout the Areas as the room schedules are completed.

Figure 1. Analysis of survey times. Building = 828 M/Hr master survey; 360 M/Hr condition survey. Engineering = 786 M/Hr master survey; 384 M/Hr condition survey.

Figure 2. St Helens & Knowsley Area Health Authority. St Helens Hospital.

Figure 3. St Helens Hospital.

Figure 4. Analysis of survey times. Building = 13.8 cu M/Minute master survey; 6.0 cu M/Minute condition survey. Engineering = 13.1 cu M/Minute master survey; 6.4 cu M/Minute condition survey.

Figure 5. Graph showing relationship of survey time + (volume × no. of areas per unit).

Departments	Volume m^3	Vol x Areas	SURVEY TIME (Hours)			
			Building Survey		Engineering Survey	
			Master	Condition	Master	Condition
Private & Amenity	1,315	56,545	2	4	2	3½
Boiler House	847	6,776	1	2½	1	2
Doctors Rooms	627	11,286	¾	—	¾	1½
Kitchen	668	5,344	1	2	1½	3
Rennie Ward	1,279	37,091	2	4	2	4
Burton Ward	1,323	26,460	1	—	1	3
Hazel Ward	1,200	25,200	1	3	1	2
	7,259		8¾	15½	9¼	19

Figure 1.

LOCATION	TIME IN HOURS			
	BUILDING		ENGINEERING	
	MASTER	CONDITION	MASTER	CONDITION
Hazel Ward	1	3	1	2
Boilerhouse	1	2½	1	3
Kitchen	1	2	1½	3
Domestic Staff	¾	1½	½	1¼
'X' Ray Department	1½	3½	1½	3
Cleaners Rooms				
Offices				
Pharmacy	11	2½	1	2½
Canteen				
Pilkington Ward	1½	3½	1½	3
Rennie Ward	2	4	2	4
Private and Amenity Wards	2	4	2	3½
Day Ward	½	1	½	¾
Operating Theatres	2	3½	2	4
Kurtz Ward	2	4	2	4
Garton Ward	2	4	2	4

Figure 2.

	TIME IN HOURS			
	BUILDING		ENGINEERING	
	MASTER	CONDITION	MASTER	CONDITION
Sub Station			1	°
Store			½	1
Record Store			½	1
Garden Shelter			—	—
Male Nurses Changing Rooms	½	1	½	1½
Social Hall	¾	1½	¾	1½
Nurses Home	10	Painting in progress	8	20
Garages & Incinerator	½	1	1	2

Figure 3.

	No. of Volume	Areas	Vol. / Areas	Vol x Areas	SURVEY TIME			
					Building Survey		Engineering Survey	
					Master	Condition	Master	Condition
Private & Amenity	1,315	43	31	56,545	120	240	120	210
Boiler House	847	8	106	6,776	60	150	60	120
Doctors Rooms	627	18	35	11,286	45	—	45	90
Kitchen	668	8	84	5,344	60	120	90	180
Rennie Ward	1,279	29	44	37,091	120	240	120	240
Burton Ward	1,323	20	63	26,460	60	—	60	180
Hazel Ward	1,200	21	57	25,200	60	180	60	120
	7,259	147			525	1,200	555	1,140

Figure 4.

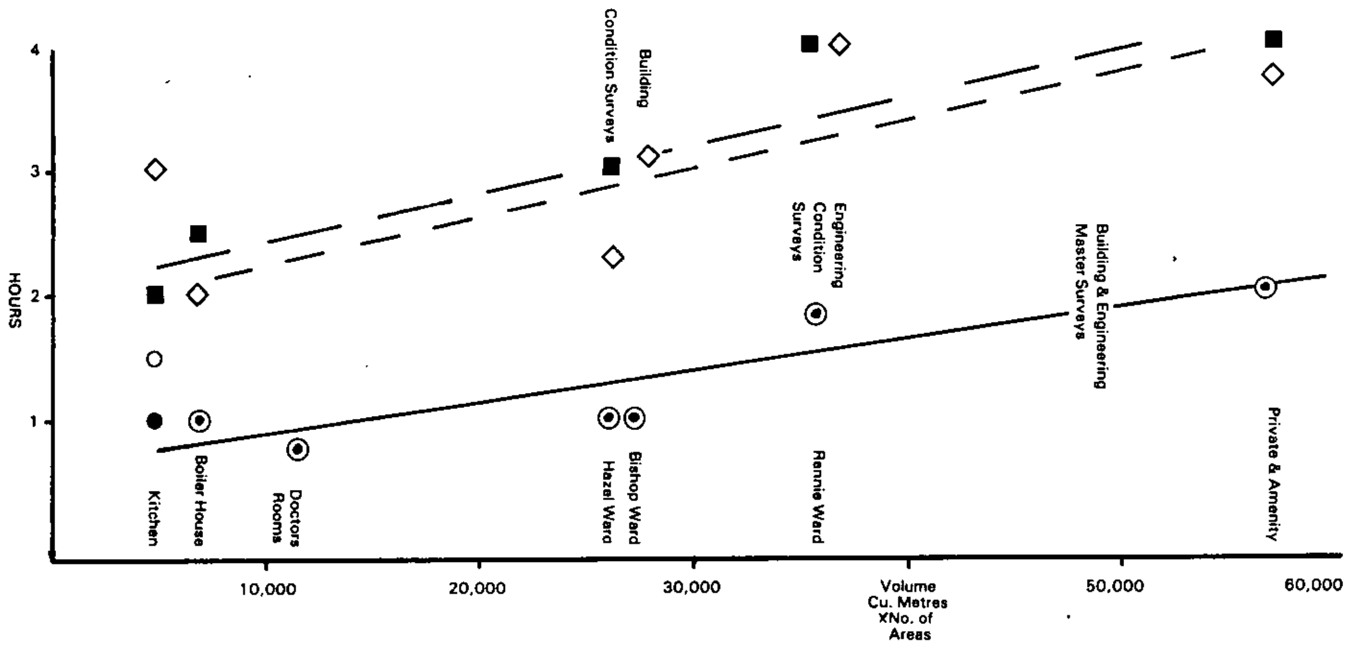


Figure 5.

Classified Advertisements

APPOINTMENTS AND SITUATIONS VACANT

South West Thames Regional Health Authority

Engineering Division

Engineering Clerk of Works

Salary Scale: £4,908–£6,183 per annum plus £141 per annum London Weighting. Commencing salary according to experience.

Applicants, male or female, must have served an apprenticeship in mechanical or electrical engineering and have had not less than 5 years' experience supervising site installations employing trades associated mechanical or electrical building services.

The appointment will be for the supervision of engineering work at various sites within the region, which covers the following area—Surrey, West Sussex and the south-west corner of London.

Initially the officers will be based at Guildford, but this could vary depending upon the location of the particular sites for which they are responsible.

Application form from Headquarters Personnel Officer, South West Thames Regional Health Authority, 40 Eastbourne Terrace, London W2 3QR. Completed forms to be returned by June 20.

Board of Governors St Peter's Hospitals

The following staff are required to assist the Group Works Officer in the operation and maintenance of all plant, engineering and building services (including minor works) at this Group of four hospitals in the Holborn/Covent Garden area.

Senior Engineer

£6,413–£7,361 pa inclusive (pay award pending)

Applicants should have served an apprenticeship and possess an HNC in mechanical or electrical engineering. A certificate in industrial administration (or other approved qualification) is essential.

Engineer

£5,873–£6,575 pa inclusive (pay award pending)

Applicants should have served an apprenticeship and possess an ONC in Engineering or an alternative qualification acceptable to the Secretary of State.

The Board is currently negotiating the introduction of the national incentive bonus scheme, a 5% bonus is currently payable to both officers. An on-call allowance of approx £468 pa is also payable.

Telephone enquiries may be made to Mr D. Blythe, Group Works Officer, Tel: 01-242 9831 ext 6.
Job description and application form available from the Personnel Department, St Philip's Hospital, Sheffield Street, London WC2A 2EX. Tel: 01-242 9831 ext 37/38.

Closing date: June 20, 1980.

Islington District
District Works Department

Sector Engineer

The salary scale is £7,022 to £8,243 pa inclusive plus 5% bonus payment.

Applications are invited for the above senior post based at the Whittington Hospital, St Mary's Wing, Highgate Hill, London N19 5NF to co-ordinate the engineering and works administration functions at that general hospital and its associated units and properties.

The successful applicant (male or female) will have served a recognised Apprenticeship in Mechanical or Electrical Engineering, have a broad experience in the operation and maintenance of health care engineering services and minor new works and sound background in the management of Works resources including the control of both directly employed and contract labour.

Applicants shall have either: HNC or City & Guilds Certificates in Mechanical or Electrical Engineering and suitable management qualifications.

Application form and job description from the Personnel Officer, Community Health Personnel Department, 159 Upper Street, London N1 Tel: 01-226 4488 ext 228/280.

For further information please contact Mr G. H. Ridley, District Engineer on 01-272 7777 ext 338.

CAMDEN & ISLINGTON
AREA HEALTH AUTHORITY (TEACHING)